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## PATENT COOPERATION TREATY

## PCT

## INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

REC'D 20 OCT 2000

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PCT

Applicant's or agent's file reference 2980368PC/su	<b>FOR FURTHER ACTION</b> See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)	
International application No. PCT/FI99/00649	International filing date (day/month/year) 03.08.1999	Priority date (day/month/year) 03.08.1998
International Patent Classification (IPC) or national classification and IPC <sub>7</sub> H 04 Q 7/38		
Applicant Nokia Networks OY et al		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.

2. This REPORT consists of a total of 5 sheets, including this cover sheet.

☐ This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of \_\_\_\_\_ sheets.

3. This report contains indications relating to the following items:

- I ☒ Basis of the report
- II ☐ Priority
- III ☐ Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV ☐ Lack of unity of invention
- V ☒ Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI ☒ Certain documents cited
- VII ☐ Certain defects in the international application
- VIII ☐ Certain observations on the international application

Date of submission of the demand  03.08.1999	Date of completion of this report  11.09.2000
Name and mailing address of the IPEA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. 08-667 72 88	Authorized officer  Jaana Raivio/mj Telephone No. 08-782 25 00

Form PCT/IPEA/409 (cover sheet) (January 1994)

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00649

## 1. Basis of the report

1. This report has been drawn on the basis of *(Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to the report since they do not contain amendments.)*:

☒ the international application as originally filed.

☐ the description, pages \_\_\_\_\_, as originally filed,  
 pages \_\_\_\_\_, filed with the demand,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 pages \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☐ the claims, Nos. \_\_\_\_\_, as originally filed,  
 Nos. \_\_\_\_\_, as amended under Article 19,  
 Nos. \_\_\_\_\_, filed with the demand,  
 Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 Nos. \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

☐ the drawings, sheets/fig \_\_\_\_\_, as originally filed,  
 sheets/fig \_\_\_\_\_, filed with the demand  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_,  
 sheets/fig \_\_\_\_\_, filed with the letter of \_\_\_\_\_.

2. The amendments have resulted in the cancellation of:

☐ the description, pages \_\_\_\_\_

☐ the claims, Nos. \_\_\_\_\_

☐ the drawings, sheets/fig \_\_\_\_\_

3. ☐ This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the supplemental Box (Rule 70.2(c)).

4. Additional observations, if necessary:

International application No.

PCT/FI99/00649

**V. Resoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**

## 1. Statement

Novelty (N)	Claims	<u>1-8</u>	YES
	Claims		NO
Inventive step (IS)	Claims	<u>1-8</u>	YES
	Claims		NO
Industrial applicability (IA)	Claims	<u>1-8</u>	YES
	Claims		NO

## 2. Citations and explanations

The claimed invention relates to a method for setting up USSD (Unstructured Supplementary Service Data) transfer for data transmission between two parties. If the mobile station is not in a call mode, a SDCCH (Slow Dedicated Control Channel) would normally be used. In the method of the claimed invention, the amount of data to be transmitted is determined and if it exceeds a predetermined amount, a FACCH (Fast Associated Control Channel) is used even though the mobile station is not in call mode. This is accomplished by directing the mobile station into call mode.

Documents cited in the International Search Report:

D1: WO 93 10600

D2: GB 2 301 749

D3: Mouly Michel et al: "The GSM system for mobile communication", 1992, p. 190-191

D4: WO 97 29597

D1 relates to a method for sustaining a predetermined level of communications service to the plurality of subscribers in the system. Control channel traffic loading can be measured and if it reaches an upper threshold, an increase in the number of control channels is advised. This increase is accomplished by assigning a control-channel capable voice channel as a temporary control channel.

D2 relates to a system capable of switching between trunked slow associated control channel and normal slow associated control channel, depending on whether the amount of signalling messages to be sent exceeds the capacity of a particular slot.

D3 describes signalling in connection with a call.

..... / .....

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00649

**Supplemental Box**

(To be used when the space in any of the preceding boxes is not sufficient)

Continuation of: V.

D4 relates to a method for checking the presence of mobile stations communicating on a direct mode channel.

Documents D1-D4 are considered to constitute the state of the art. None of D1-D4 show a method for directing a mobile station, not involved in a call, into call mode, in order to enable the use of a FACCH for a USSD transfer. The invention as claimed in claims 1-8 is, with reference to D1-D4, novel and considered to involve an inventive step. The invention as claimed in claims 1-8 is considered to have industrial applicability.

# INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/FI99/00649

## VI. Certain documents cited

### 1. Certain published documents (Rule 70.10)

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
WO 9920069	22.04.1999	29.09.1998	

### 2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)

# RECORD COPY

1/4

## PCT REQUEST

2980368PC/nu

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0	For receiving Office use only	
0-1	International Application No.	PCT/FI 9 9 / 0 0 6 4 9
0-2	International Filing Date	0 3 AUG 1999 ( 0 3. 08. 99 )
0-3	Name of receiving Office and "PCT International Application"	The Finnish Patent Office PCT International Application
0-4	Form - PCT/RO/101 PCT Request Prepared using	PCT-EASY Version 2.84 (updated 01.07.1999)
0-5	Petition The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty	
0-6	Receiving Office (specified by the applicant)	National Board of Patents and Registration (Finland) (RO/FI)
0-7	Applicant's or agent's file reference	2980368PC/nu
I	Title of invention	USSD TRANSFER MECHANISM
II	Applicant	
II-1	This person is:	applicant only
II-2	Applicant for	all designated States except US
II-4	Name	NOKIA TELECOMMUNICATIONS OY
II-5	Address:	Keilalahdentie 4 FIN-02150 Espoo Finland
II-6	State of nationality	FI
II-7	State of residence	FI
III-1	Applicant and/or inventor	
III-1-1	This person is:	applicant and inventor
III-1-2	Applicant for	US only
III-1-4	Name (LAST, First)	TARNANEN, Teemu
III-1-5	Address:	Kaskipuunkaari 5 C 6 FIN-02340 Espoo Finland
III-1-6	State of nationality	FI
III-1-7	State of residence	FI
III-2	Applicant and/or inventor	
III-2-1	This person is:	applicant and inventor
III-2-2	Applicant for	US only
III-2-4	Name (LAST, First)	YLIHARJU, Sami
III-2-5	Address:	Liusketie 3 E 65 FIN-00710 Helsinki Finland
III-2-6	State of nationality	FI
III-2-7	State of residence	FI

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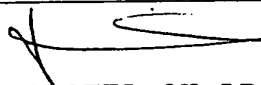
IV-1	Agent or common representative; or address for correspondence The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:	agent
IV-1-1	Name	KOLSTER OY AB
IV-1-2	Address:	Iso Roobertinkatu 23 P.O. Box 148 FIN-00121 Helsinki Finland
IV-1-3	Telephone No.	358 9 618 821
IV-1-4	Facsimile No.	358 9 602 244
IV-1-5	e-mail	kolster@kolster.fi
V	Designation of States	
V-1	Regional Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AP: GH GM KE LS MW SD SL SZ UG ZW and any other State which is a Contracting State of the Harare Protocol and of the PCT EA: AM AZ BY KG KZ MD RU TJ TM and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT EP: AT BE CH&LI CY DE DK ES FI FR GB GR IE IT LU MC NL PT SE and any other State which is a Contracting State of the European Patent Convention and of the PCT OA: BF BJ CF CG CI CM GA GN GW ML MR NE SN TD TG and any other State which is a member State of OAPI and a Contracting State of the PCT
V-2	National Patent (other kinds of protection or treatment, if any, are specified between parentheses after the designation(s) concerned)	AE AL AM AT (patent and utility model) AU AZ BA BB BG BR BY CA CH&LI CN CR CU CZ (patent and utility model) DE (patent and utility model) DK (patent and utility model) EE (patent and utility model) ES FI (patent and utility model) GB GD GE GH GM HR HU ID IL IN IS JP KE KG KP KR KZ LC LK LR LS LT LU LV MD MG MK MN MW MX NO NZ PL PT RO RU SD SE SG SI SK (patent and utility model) SL TJ TM TR TT UA UG US UZ VN YU ZA ZW



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V-5	Precautionary Designation Statement In addition to the designations made under items V-1, V-2 and V-3, the applicant also makes under Rule 4.9(b) all designations which would be permitted under the PCT except any designation(s) of the State(s) indicated under item V-6 below. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit.	
V-6	Exclusion(s) from precautionary designations	NONE
VI-1	Priority claim of earlier national application	
VI-1-1	Filing date	03 August 1998 (03.08.1998)
VI-1-2	Number	981692
VI-1-3	Country	FI
VI-2	Priority document request The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) identified above as item(s):	VI-1
VII-1	International Searching Authority Chosen	Swedish Patent Office (ISA/SE)
VIII	Check list	number of sheets      electronic file(s) attached
VIII-1	Request	4      -
VIII-2	Description	7      -
VIII-3	Claims	2      -
VIII-4	Abstract	1      2980368p.txt
VIII-5	Drawings	1      -
VIII-7	TOTAL	15
VIII-8	Accompanying items	paper document(s) attached      electronic file(s) attached
VIII-10	Fee calculation sheet	✓      -
VIII-10	Copy of general power of attorney	✓      -
VIII-16	PCT-EASY diskette	-      diskette
VIII-18	Figure of the drawings which should accompany the abstract	1
VIII-19	Language of filing of the international application	English
IX-1	Signature of applicant or agent	 Tapio Valkeiskangas
IX-1-1	Name	KOLSTER OY AB

## FOR RECEIVING OFFICE USE ONLY

10-1	Date of actual receipt of the purported international application	03 AUG 1999      ( 03 -08- 1999 )
10-2	Drawings:	
10-2-1	Received	
10-2-2	Not received	

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10-3	Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application	
10-4	Date of timely receipt of the required corrections under PCT Article 11(2)	
10-5	International Searching Authority	ISA/SE
10-6	Transmittal of search copy delayed until search fee is paid	

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08.11.2000

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Kolster Oy Ab

10-11-2000

Iso Roobertinkatu 23

00120 Helsinki

KOLSTER OY AB

Patenttihakemus nro: 981692  
Luokka: H04Q 7/38 / SIO  
Hakija: Nokia Networks Oy  
Asiamies: Kolster Oy Ab  
Asiamiehen viite: 2980368FI  
Määräpäivä: 08.05.2001

13 s.

Patenttihakemuksen numero ja luokka on mainittava kirjelmässänne PRH:lle

Suoritetun uutuustutkimuksen perusteella hakemuksessa kuvattu keksintö USSD-siirron muodostamiseksi on patentoitavissa, ja vaatimukset ovat hyväksyttävissä.

Oheisena lähetetään asiakirjat, jotka osoittavat, missä muodossa virasto aikoo myöntää patentin. Teidän tulee määräjän kuluessa antaa lausumanne siitä, hyväksyttekö Te tämän muodon. Viraston asiakirjat tulee palauttaa.

Hakijaa pyydetään toimittamaan vaatimukset ruotsinkielisinä.

Yleisen tekniikan tason osalta viitataan julkaisuun EP 840531, joka käsittelee vaihtuvanpituisten USSD-sanomien siirtoa ja näyttämistä. Lisäksi viitataan julkaisuihin GB 2301749 ja US 5442809, jotka esittävät ratkaisuja signaalointikapasiteetin järjestämiseksi väliaikaisesti liikennekanavien kapasiteetista tai päinvastoin.



Tutkijainsinööri  
Puhelin:

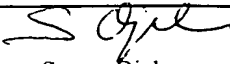
Seppo Ojala  
(09) 6939 5318

Liitteenä hakemusasiakirjat sekä tutkimusraportin ja viitejulkaisujen kopiot

Lausumanne on annettava viimeistään yllämainittuna määräpäivänä. Jollette ole antanut lausumanne virastoon viimeistään mainittuna määräpäivänä tai ryhtynyt toimenpiteisiin tässä välipäätöksessä esitettyjen puutteellisuuden korjaamiseksi, jätetään hakemus sillensä (patenttilain 15 §). Sillensä jätetty hakemus otetaan uudelleen käsiteltäväksi, jos Te neljän kuukauden kuluessa määräpäivästä annatte lausumanne tai ryhdytte toimenpiteisiin esitettyjen puutteellisuuden korjaamiseksi ja samassa ajassa suoritate vahvistetun maksun, 320 mk hakemuksen ottamisesta uudelleen käsiteltäväksi. Jos lausumanne on annettu virastoon oikeassa ajassa, mutta esitettyjä puutteellisuuden ei ole siten korjattu, että hakemus voitaisiin hyväksyä, se hylätään, mikäli virastolla ei ole aihetta antaa Teille uutta välipäätöstä (patenttilain 16 §). Uusi keksinnön selitys, siihen tehdyt lisäykset ja uudet patenttivaatimukset on aina jätettävä kahtena kappaleena ja tällöin on otettava huomioon patenttiasetuksen 19 §.

<b>PATENTTIHAKEMUS NRO</b>  981692	<b>LUOKITUS</b>  H04Q 7/38, 7/22
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<b>TUTKITTU AINEISTO</b>
<b>Patenttijulkaisukokoelma (FI, SE, NO, DK, DE, CH, EP, WO, GB, US), tutkitut luokat</b>  H04Q 7/22, 7/38 FI
<b>Tiedonhaut ja muu aineisto</b>  Epoque: Epodoc, WPI, Paj, Full Text

<b>VIITEJULKAISUT</b>		
<b>Kategoria*)</b>	<b>Julkaisun tunnistetiedot</b>	<b>Koskee vaatimuksia</b>
A	EP-A2-840531, Nokia Mobile Phones LTD., 6.5.98, H04Q 7/22	
A	GB-A-2301749, Motorola Limited, 11.12.96, H04J 3/12	
A	US-A-5442809, Diaz et al., 15.8.95, H04Q 7/38	
*) X Patentoitavuuden kannalta merkittävä julkaisu yksinään tarkasteltuna Y Patentoitavuuden kannalta merkittävä julkaisu, kun otetaan huomioon tämä ja yksi tai useampi samaan kategoriaan kuuluva julkaisu A Yleistä tekniikan tasoa edustava julkaisu, ei kuitenkaan patentoitavuuden este		
<b>Päiväys</b>  8.11.2000	<b>Tutkija</b>  Seppo Ojala	

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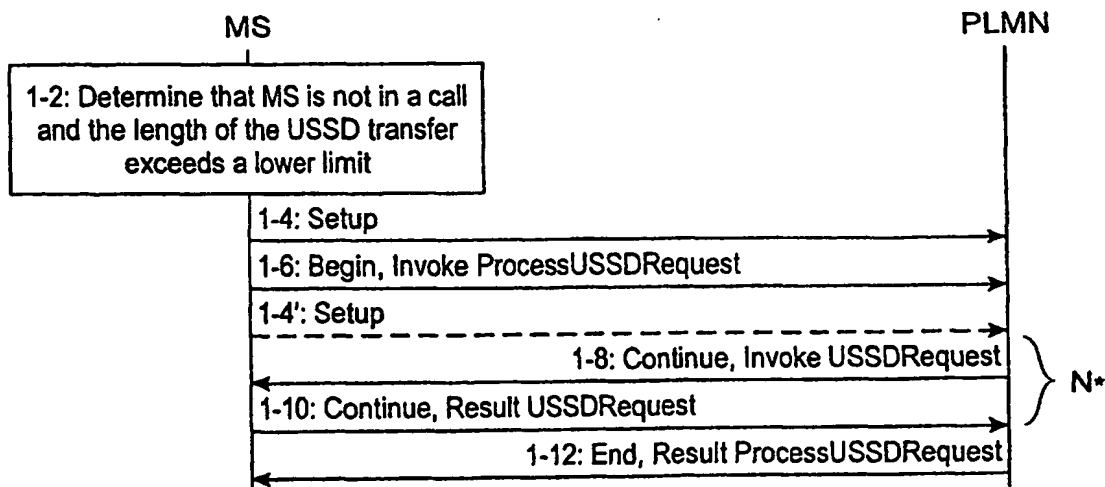
WORLD INTELLECTUAL PROPERTY ORGANIZATION  
International Bureau



INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 7 : <b>H04Q 7/38</b>		<b>A1</b>	(11) International Publication Number: <b>WO 00/08885</b>
			(43) International Publication Date: 17 February 2000 (17.02.00)
(21) International Application Number: PCT/FI99/00649 (22) International Filing Date: 3 August 1999 (03.08.99) (30) Priority Data: 981692 3 August 1998 (03.08.98) FI (71) Applicant (for all designated States except US): NOKIA NETWORKS OY [FI/FI]; Keilalahdentie 4, FIN-02150 Espoo (FI). (72) Inventors; and (75) Inventors/Applicants (for US only): TARNANEN, Teemu [FI/FI]; Kaskipuunkaari 5 C 6, FIN-02340 Espoo (FI). YLIHARJU, Sami [FI/FI]; Liusketie 3 E 65, FIN-00710 Helsinki (FI). (74) Agent: KOLSTER OY AB; Iso Roobertinkatu 23, P.O. Box 148, FIN-00121 Helsinki (FI).		(81) Designated States: AE, AL, AM, AT, AT (Utility model), AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CR, CU, CZ, CZ (Utility model), DE, DE (Utility model), DK, DK (Utility model), EE, EE (Utility model), ES, FI, FI (Utility model), GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SK (Utility model), SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, SD, SL, SZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG).  <b>Published</b> <i>With international search report.          Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>	

(54) Title: METHOD FOR IMPROVING THE PERFORMANCE OF USSD TRANSFER IN A CELLULAR COMMUNICATIONS SYSTEM



(57) Abstract

In the GSM and similar systems, USSD (Unstructured Supplementary Service Data) transfer takes place on a fast channel (FACCH) if a mobile station is involved in a call, and otherwise on a slow channel (SDCCH). The USSD transfer can be switched to the fast channel by determining (1-2, 2-2) the amount of data to be transmitted. If the amount of data to be transmitted is likely to exceed a predetermined threshold, and if the mobile station (MS) is not involved in a call, a call attempt (1-4, 1-4'; 2-4, 2-4') is initiated for switching the USSD transfer to the fast channel (FACCH).

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## METHOD FOR IMPROVING THE PERFORMANCE OF USSD TRANSFER IN A CELLULAR COMMUNICATIONS SYSTEM

### BACKGROUND OF THE INVENTION

The invention relates to improving the performance of USSD (Unstructured Supplementary Service Data) transfer in a cellular communications system, such as GSM (Global System for Mobile Communication).

The user of a mobile station (MS) can use USSD to give instructions to the supporting PLMN (Public Land based Mobile Network). For example, incoming calls can be routed to number 123456 by dialling \*21\*#123456#. USSD is also one of the mechanisms for implementing new services. USSD allows an MS and a service application to communicate with each other by character strings, in a way which is transparent to the MS and to the intermediate network elements. USSD can be used as a narrow-band bearer for over-the-air (OTA) and value-added services (VAS) applications. With respect to a more detailed description of the USSD, reference is made to the following ETSI GSM recommendations: GSM 02.90: *European digital cellular telecommunications system (Phase 2); Stage 1 description of Unstructured Supplementary Service Data (USSD)*, GSM 03.90: *Digital cellular telecommunications system (Phase 2); Unstructured Supplementary Service Data (USSD) - Stage 2*, and GSM 04.90: *European digital cellular telecommunications system (Phase 2); Unstructured Supplementary Service Data (USSD) - Stage 3*. USSD requests, notifications and responses contain a USSD string, an alphabet indicator and a language indicator, as defined in GSM 03.38.

USSD signalling may be initiated by the mobile station or by the network. Phase 1 supports only MS-initiated USSD. Network-initiated USSD service requires that all parts of the mobile communications system be at least phase 2 systems. The mobile communications network may at any time send a USSD message to a mobile station MS registered with the network in order to transmit information to the subscriber. This operation may be either a request (asking the MS to provide information) or a notification (requiring no information to be provided by the MS). No prior provisioning of USSD is required, although provisioning of services which make use of USSD may be required.

According to the above ETSI recommendations, USSD signalling takes place between an MS and an MSC/VLR (Mobile services Switching Centre/Visitor Location Register) or HLR (Home Location Register). USSD supports a maximum of 160 bytes of user data per message. (The upper limit

can be less than 160 bytes depending on the underlying protocol layers.) Unlike SMS (Short Message Service), USSD has no store-and-forward functionality: mobile-terminated USSD messages are delivered to the MS immediately, or the delivery fails (e.g. because the MS is unreachable).

5 For the purposes of this application, a GSM-type mobile station has two modes: a call mode and an idle mode. A mobile station is in call mode if and only if it is "in a call", which state is defined in the GSM recommendation 02.30.

10 According to the above ETSI recommendations, USSD transfer takes place on two different channels depending on whether or not the MS is in call mode or idle mode. In call mode, Fast Associated Control Channel (FACCH) is used. In idle mode, Slow Dedicated Control Channel (SDCCH) is used.

15 The speed of the FACCH channel is approximately 140 bytes per second and that of the SDCCH channel approximately 83 bytes per second. Thus, even in idle mode, any USSD message can be delivered in less than two seconds.

20 It is conceivable that the use of USSD for implementing value-added and over-the-air services will increase. In this case, especially if multiple consecutive USSD messages are needed, the slow transfer speed of the SDCCH channel could be seen as a problem. (It should be noted that for keeping the description compact, FACCH is used as a synonym for the fast channel, and SDCCH is used as a synonym for the slow channel. However, FACCH and SDCCH are terms used in the GSM system and its derivatives, 25 but these terms are not necessarily used in future cellular systems.)

#### BRIEF SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to study whether the speed of USSD in idle mode can be improved, and if yes, to provide a method and equipment for improving the speed of USSD in idle mode. The 30 object is achieved with a method and equipment which are characterized by what is disclosed in the attached independent claims. Preferred embodiments are disclosed in the attached dependent claims.

A straightforward way of improving the speed of USSD transfer would be to specify that all USSD traffic takes place on the fast FACCH channel. This would, however, require changes in existing standardisation. Also, 35 FACCH is not a dedicated channel, but an associated one, which means that it



is implemented by stealing bits from the speech channel, if one exists. If such bit stealing is allowed to go on for long periods of time, it will degrade speech quality to some extent.

The invention is based on locating the problem and finding a solution for it. The solution is based on the idea that the amount of USSD data is determined, and if the amount exceeds (or is likely to exceed) a predetermined threshold (i.e. for lengthy USSD transmissions), the faster FACCH channel is activated by directing the MS into call mode. A simple way of accomplishing this is performing an unsuccessful call attempt.

Thus it can also be said that the invention is based on a novel interpretation of call mode, as specified in the above-referenced GSM recommendation 02.30, wherein call mode is defined as follows: *A mobile station is in a call from the time that signalling related to the establishment or attempted establishment of a mobile originated or mobile terminated call commences, and before the call or call attempt ends, and (if applicable), the mobile equipment has stopped generating tones related to this call to the user.* Fooling the MS into call mode (by performing an unsuccessful call attempt) activates the faster FACCH channel for USSD transfer. However, it should be noted that the mobile station is "in a call" as defined by ETSI GSM 02.30, whereby the invention requires no deviations from existing standards. Thus the method and equipment according to the invention solve the problem of the prior art USSD transfer in an elegant manner.

The invention is also based on determining the amount of USSD data (i.e. the length of USSD transmission) and using the FACCH channel only for lengthy USSD transmissions. Performing an unsuccessful call attempt for short USSD transmissions would create unnecessary signalling load, which is especially harmful at the air interface. This signalling load must be balanced against the savings in time brought about by the mechanism of the invention. For example, FACCH could be used only if using it saves at least one second. Because FACCH transfer is approximately 1.7 times faster than SDCCH transfer, it saves about 40% of the time needed by the SDCCH transfer. If it is required that at least one second must be saved, a minimum length for a USSD message would be 250 bytes. This exceeds the length of a single USSD message. In other words, performing the unsuccessful call attempt is useful only with multiple consecutive USSD messages (assuming 83 and 140 bytes per second for SDCCH and FACCH, respectively, and a minimum sav-

ing of one second). Of course, it must be remembered that initiating the unsuccessful call attempt wastes a fraction of a second. Thus the logic for initiating the unsuccessful call attempt should be placed at the top of the protocol stack, i.e. in the application layer. Otherwise the logic will not know that multiple USSD messages are needed.

#### BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWING

The method and the equipment according to the invention will be described in more detail by means of a preferred embodiment with reference to the appended drawing on which:

Fig. 1 is a signalling diagram illustrating mobile-originated USSD transfer; and

Figs. 2 and 3 are signalling diagrams illustrating network-originated USSD transfer.

#### DETAILED DESCRIPTION OF THE INVENTION

Fig. 1 is a signalling diagram illustrating mobile originated USSD transfer. Time advances from top to bottom. A USSD dialogue between two parties will be described. One of the parties is a mobile station MS and the other is a part or an element of a public land based mobile network PLMN serving that MS. The MS can be a small handportable cellular radio telephone but the invention is best utilised if the mobile station comprises or is associated with data processing equipment. An example of such a mobile station is Nokia Communicator 9000. Another example is a general-purpose portable computer connected with a Nokia Cellular Datacard to a cellular radio telephone with a suitable interface, such as Nokia 2110 or 8110. All Nokia equipment is available from Nokia Mobile Phones, Finland.

In step 1-2 a mobile station MS in idle mode determines that the length of the USSD transfer exceeds a predetermined threshold, which could be approximately 250 bytes. In step 1-4 the MS initiates a call attempt that ultimately should fail. One way of achieving this is calling a non-existent number. Alternatively, the MS could call itself. (At some later stage, the network PLMN will reply that the called subscriber does not answer, but this reply is not significant for understanding the invention.) Steps 1-6 through 1-12 constitute a mobile-originated USSD dialogue which is known per se. In step 1-6 the MS initiates the USSD dialogue by sending a BEGIN, INVOKE PROCESSUSSD-REQUEST message to the network. (The primed message 1-4' will be explained

later.) In step 1-8 the network responds with a CONTINUE, INVOKEUSSD-REQUEST message. In step 1-10 the MS sends a CONTINUE, RESULT USSDREQUEST message. The symbol "N\*" indicates that the dialogue can comprise multiple pairs of messages 1-8 and 1-10. Finally, in step 1-12, the  
5 USSD dialogue is terminated by an END, RESULT PROCESSUSSDREQUEST message from the network.

The primed message 1-4' relates to an alternative embodiment of the mobile-originated USSD transfer according to the invention, wherein the call attempt 1-4 is not performed before message 1-6 but only after it. In this  
10 case, the call attempt is shown with reference number 1-4'. In other words, it is also possible for a mobile station to initiate the USSD dialogue in step 1-6 before performing the call attempt in step 1-4'. Thus steps 1-4' and 1-6 are not performed in numerical order.

The lower limit for activating the FACCH channel can be fixed, e.g.  
15 approximately 250 bytes (which corresponds to a saving of one second over SDCCH). Alternatively, the lower limit can be an adjustable network parameter which the network distributes by some suitable means, such as broadcasting, short message service, multipoint transmission (in packet radio networks), etc.

Fig. 2 is a signalling diagram illustrating a simple embodiment of a  
20 network-originated USSD transfer according to the invention. Messages with identical reference numbers to those in Fig. 1 have identical function and will not be described again. Step 2-2 corresponds to step 1-2 but in this case, the network determines that the mobile station MS is in idle mode and the length of the USSD transfer justifies the use of the faster FACCH channel (i.e. it ex-  
25 ceeds a lower limit). In step 2-4 the network initiates a call attempt. However, unlike step 1-4 shown in Fig. 1, the network cannot call a non-existent number (obviously, because the MS would not be alerted). Instead, the network can send to the MS a PAGE message in step 2-4. Steps 2-6 through 2-12 constitute a network-originated USSD dialogue which is known per se. In step 2-6 the  
30 network initiates the USSD dialogue by sending a BEGIN, INVOKE USSDREQUEST message to the MS. The primed message 2-4' relates to an alternative embodiment wherein the PAGE message is sent after the message 2-6, like the alternative setup message 1-4' in Fig. 1. Messages 1-8 and 1-10 have already been explained. In step 2-12, the USSD dialogue is terminated  
35 by an END message.

Fig. 3 is a signalling diagram illustrating a preferred embodiment of a network-originated USSD transfer according to the invention. The simple embodiment shown in Fig. 2 has the problem of confusing the user of the MS by the unsuccessful call attempt. The preferred embodiment shown in Fig. 3 eliminates this problem by converting a network-originated call attempt to a mobile originated one. In step 3-2 the network PLMN sends to the MS an indication that the MS must initiate a call setup procedure for activating the FACCH channel. This indication can be embedded, for example, inside a protocol-specific header or parameter in an appropriate WAP (Wireless Application Protocol) layer. In the embodiment shown in Fig. 3, this indication has been embedded in the BEGIN, INVOKE USSDREQUEST message which was shown as step 2-6 in Fig. 2. In step 1-4 the MS initiates the unsuccessful call attempt by sending a SETUP message. The remainder of the procedure is similar to the one described in connection with Fig. 2.

The preferred embodiment of the network-originated USSD transfer has several advantages over the simple embodiment. For example, no special call setup routines are required in the network. Also, because the MS does not have to be paged, call setup is faster and the user of the MS is not alerted.

The invention requires neither hardware changes nor changes to existing GSM standards. The invention can be implemented as software routines in a mobile station and/or the Public Land based Mobile Network PLMN. In the mobile station, the software routine can be installed in the cellular telephone proper, or in the associated computer, if any. Installing the software routine in the associated computer, if applicable, is advantageous in the sense that such software has a better chance of knowing or predicting the total number of USSD messages that will follow, and their combined length. Alternatively, the software routine according to the invention can be installed in the cellular telephone proper but the associated computer could give the software routine an indication that several USSD messages are likely to follow and the FACCH channel should be activated.

In the PLMN, the invention is preferably implemented in a more distributed manner. The logic for determining if multiple USSD messages will be needed must be placed near the actual application. Typical network elements for executing OTA and VAS applications include Mobile services Switching Centres, USSD centres, Home Location Registers and Visitor Location Registers of cellular communications systems and Service Control Points of intelli-

gent networks. The logic for performing the unsuccessful call attempt, as described in connection with Figs. 2 and 3, is preferably installed in a Mobile services Switching Centre. Other possible locations include a BTS (Base Transceiver Station), a BSC (Base Station Controller), and/or an RNC (Radio  
5 Network Controller).

The invention has been described, by way of example, in connection with the GSM cellular system (Global System for Mobile Communication). The invention is equally applicable in connection with the derivatives of GSM, such as DCS (also known as GSM 1800), and any digital mobile communica-  
10 tions network supporting USSD transfer on a fast channel if a mobile station is in a call, and otherwise on a slow channel.

## CLAIMS

1. A method for setting up USSD transfer for transmitting data between two parties, namely a mobile station (MS) and a cellular communications network (PLMN), wherein the USSD transfer takes place on a fast channel (FACCH) if the mobile station is involved in a call, and otherwise on a slow channel (SDCCH);

the method being characterized in that:

the amount of data to be transmitted is determined (1-2, 2-2); and

if the amount of data to be transmitted is likely to exceed a predetermined threshold, and if the mobile station (MS) is not involved in a call, the mobile station (MS) is directed to call mode for switching the USSD transfer to the fast channel (FACCH).

2. A method as claimed in claim 1, characterized in that the mobile station is directed into call mode by initiating a call attempt (1-4, 1-4'; 2-4, 2-4').

3. A method as claimed in claim 1 or 2, characterized in that the party (MS, PLMN) that initiates the USSD transfer also initiates the call attempt (1-4, 1-4'; 2-4, 2-4').

4. A method as claimed in claim 1 or 2, characterized in that the network (PLMN), when initiating the USSD transfer, sends the mobile station (MS) an indication (3-2) that the mobile station (MS) must initiate the call attempt (1-4, 1-4').

5. A method as claimed in any one of the preceding claims, characterized in that the mobile station (MS), when initiating the call attempt (1-4, 1-4'), calls a non-existent number or itself.

6. A mobile station (MS), adapted for setting up USSD transfer for transmitting data between itself and a cellular communications network (PLMN), wherein the USSD transfer takes place on a fast channel (FACCH) if the mobile station is involved in a call, and otherwise on a slow channel (SDCCH);

characterized in that the mobile station (MS) is adapted to:  
determine (1-2) the amount of data to be transmitted; and

initiate a call attempt (1-4, 1-4') for switching the USSD transfer to the fast channel (FACCH) if the amount of data to be transmitted is likely to exceed a predetermined threshold and if the mobile station (MS) is not involved in a call.

- 5           7. An arrangement for a cellular communications network (PLMN), adapted for setting up USSD transfer for transmitting data between itself and a mobile station (MS), wherein the USSD transfer takes place on a fast channel (FACCH) if the mobile station (MS) is involved in a call, and otherwise on a slow channel (SDCCH);

- 10           c h a r a c t e r i z e d in that the arrangement is adapted to:  
determine (2-2) the amount of data to be transmitted; and  
initiate a call attempt (1-4, 1-4'; 2-4, 2-4') for switching the USSD transfer to the fast channel (FACCH) if the amount of data to be transmitted is likely to exceed a predetermined threshold and if the mobile station (MS) is not  
15 involved in a call.

8. An arrangement as claimed in claim 7, c h a r a c t e r i z e d in that it is adapted to initiate a call attempt (1-4, 1-4') by sending to the mobile station (MS) an indication (3-2) that the mobile station (MS) must initiate the call attempt.

Fig. 1

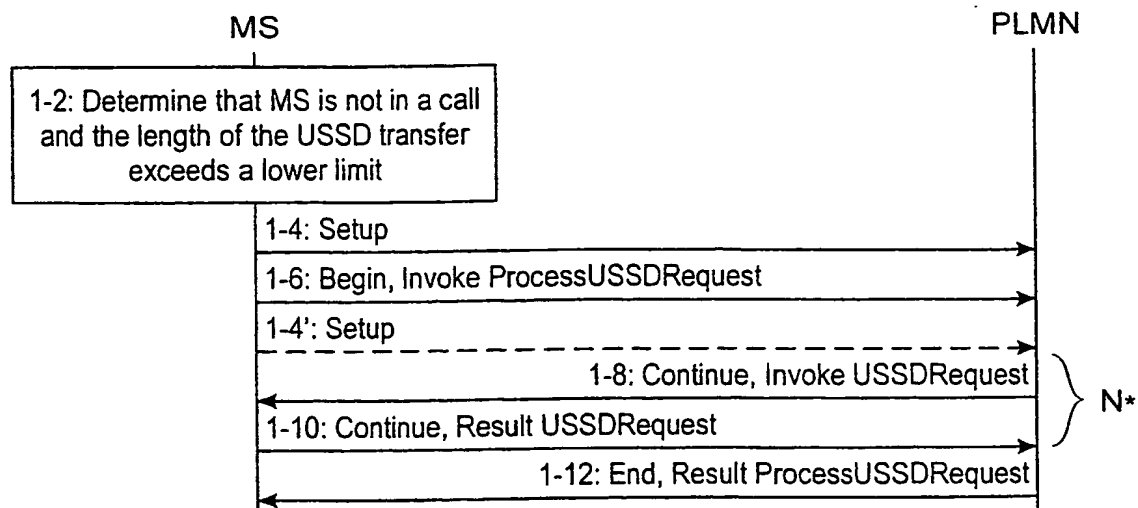


Fig. 2

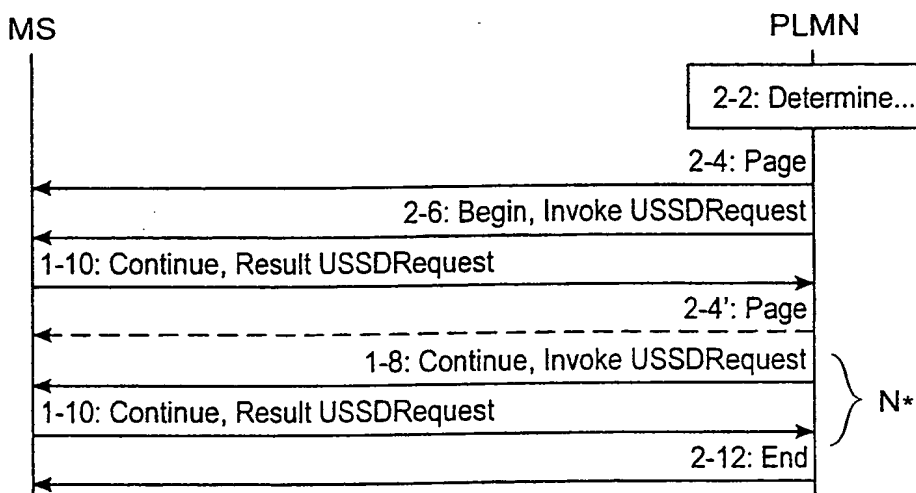
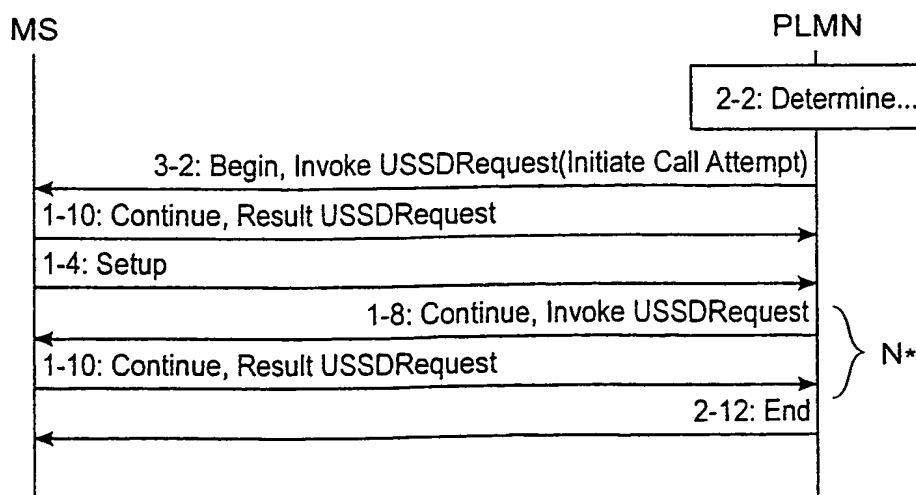


Fig. 3





## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 99/00649

## A. CLASSIFICATION OF SUBJECT MATTER

IPC7: H04Q 7/38

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC7: H04Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

SE,DK,FI,NO classes as above

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

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X	WO 9310600 A1 (MOTOROLA, INC.), 27 May 1993 (27.05.93), page 8, line 17 - page 9, line 9; page 15, line 24 - page 17, line 8 --	1,2,3,6,7
A	GB 2301749 A (MOTOROLA LIMITED), 11 December 1996 (11.12.96), page 2, line 16 - page 4, line 11, abstract --	1,2,3,6,7
A	Mouly Michel et al, "The GSM System for Mobile communication", 1992, page 190 - page 191 --	1,2,3,6,7



Further documents are listed in the continuation of Box C.



See patent family annex.

\* Special categories of cited documents

"A" document defining the general state of the art which is not considered to be of particular relevance

"B" earlier document but published on or after the international filing date

"I" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"I" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance: the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance: the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&amp;" document member of the same patent family

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Name and mailing address of the ISA/  
Swedish Patent Office  
Box 5055, S-102 42 STOCKHOLM  
Facsimile No. +46 8 666 02 86

Authorized officer

Per Källquist/cs  
Telephone No. +46 8 782 25 00

## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI 99/00649

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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A	WO 9729597 A2 (NOKIA TELECOMMUNICATIONS OY), 14 August 1997 (14.08.97), page 4, line 24 - page 5, line 35  -- -----	4,5,8

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Information on patent family members

02/12/99

International application No.  
PCT/FI 99/00649

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